Remarks

The Office Action mailed June 14, 2006 has been carefully considered. The Office maintains its rejection of Claims 1-2, 4, 7, and 10-11 as unpatentable over Weibel, Arena, and Vovlas et al. The Office maintains its rejection of Claim 8 as unpatentable over Weibel, Arena and Vovlas et al., in further view of Gatzi et al. The Office rejects Claim 12 as unpatentable over Weibel, Arena, and Vovlas et al. And the Office rejects new Claim 13 as unpatentable over Weibel, Arena and Vovlas et al., in further view of Gatzi et al.

Applicants have currently amended Claims 1, 8, 10, 11, and 12 to narrow the hydrochloric acid concentration to a range from 0.01N to 0.10N, and to narrow the oxalic acid concentration to a range from 0.01N to 0.50N. Support for these amendments may be found, for example, in Tables 2 and 3 of the Examples in the application as filed.

These amendments further distinguish the present invention from Arena. Arena uses a strong acid of high concentration (col. 3, lines 13-28). Arena's acid concentration is typically from about 0.5% to about 15% by weight, and more typically from about 3% to about 10% by weight. When Arena's strong acid is hydrochloric acid, 0.5%-15% by weight corresponds to 0.16N to 4.86N. When Arena's strong acid is sulfuric acid, 0.5%-15% by weight corresponds to 0.19N to 5.63N.

Applicants traverse the above rejections in light of the current amendments and following remarks.

As the Office is aware, a rejection for a claim of obviousness must contain a suggestion or motivation to combine the prior art references in such a way as to achieve the claimed invention. *In re Vaeck*, 947 F.2d 488 (Fed. Cir. 1991). In addition, there must be a finding that one of ordinary skill in the art at the time the invention was made would have reasonably expected the claimed invention to work. *In re Dow Chem.*, 837 F.2d, 473, (Fed. Cir. 1988).

Weibel Teaches Away

Previously, applicants argued that unlimiting statements, e.g., Wiebel's general statement that "other parenchymal cell-containing plants may be used", do not provide the motivation needed to combine Weibel's method with corn kernel hulls. *In re Benno*, 226 U.S.P.Q. 683,687 (Fed. Cir. 1985). In response, the Office argued that one cannot show nonobviousness by

attacking references individually where the rejections are based on combinations of references. As the Office is aware, it is nonetheless improper to combine references where the references teach away from their combination. *In re Grasselli*, 713 F.2d 731, 743 (Fed. Cir. 1983). It is important to note that a reference that discloses a broad genus, but only focuses on a first structurally unique group within that genus, may teach away from a second group in that genus, if that second group has different structure than the first group. *In re Baird*, 29 USPQ2d 1550, 1552 (Fed. Cir. 1994).

In *In re Baird*, the reference disclosed a generic formula for a diphenol, which was inclusive of the claimed invention. *Id* at 1552. The generic reference, while inclusive of a large number of variables or species, focused on only a few species that were more complex than the claimed invention. *Id.* The Office argued that the generic reference rendered the claimed invention obvious. The Board agreed with the Office. The Federal Circuit reversed the Office and the Board. *Id.*

The Federal Circuit held "while the [generic reference] unquestionably encompasses [the claimed invention] when specific variables are chosen, there is nothing in the disclosure of [the generic reference] suggesting that one should select such variables. Indeed, [the generic reference] appears **to teach away from** the selection of [the claimed invention] by focusing on more complex [species]." *Id* (emphasis added).

Weibel is a generic reference disclosing that "other parenchymal cell-containing plants may be used". The parenchymal cell is one of the most frequently occurring cell types in the plant kingdom. It is "abundant in leaves, roots, and the pulp of fruit, and found also in leaves and stems." *McGraw-Hill Dictionary of Scientific and Technical Terms*, (2nd ed., McGraw-Hill 1978)(copy enclosed). Weibel's generic disclosure is inclusive of virtually all of the various parts of virtually all of the various plants in the world. Weibel, however, only focuses on a very small group within that much larger group: sugar beet and citrus fiber pulp. These are structurally very different than corn kernel hulls.

The hemicellulose component of sugar beet fiber used by Weibel contains about 60% L-arabinose, about 30% D-galactose and about 10% l-rhamnose. *See* Guillion, F. *et al.*, *Carbohydr. Res.*, 190 (1), pp85, 1989 (Table 1, "HP" or "HP ("hairy")"))(copy attached). Thus, selectively producing L-arabinose from Weibel's starting material starts out with the advantage that L-

arabinose is already the majority component. Corn kernel hulls are much different. The hemicellulose component of corn kernel hulls is arabinoxylan, which contains about 52 % D-xylose and about 28% L-arabinose. See Saulnier et al., *Isolation and Partial Characterization of Feruloylated Oligosaccharides from Maize Bran*, Carbohydr. Res. vol. 272, p. 241-242 (1995) (*noting* values of p. 242, lines 23-29, multiplied by 100/60 to show percentage based on heteroxylan content).

Weibel is like the generic reference in *In re Baird*; Weibel mentions a broad genus, but focuses on a narrow species within that genus. Weibel's narrow species is structurally very different from corn kernel hull because it contains different constituents in different amounts. Weibel, like the generic reference in *In re Baird*, would lead one of ordinary skill toward parenchymal material like sugar beet or citrus pulp; Weibel, like the generic reference in *In re Baird*, teaches away from corn kernel hulls. Applicants submit that, for at least this reason, the claimed invention is patentable over the improper combination. The patentability of the claimed invention is further strengthen by the fact that Arena also teaches away from Weibel.

Arena Teaches Away

Arena expressly teaches away from Weibel's (1) temperature and (2) acid concentration.

Arena teaches away from Weibel's temperature in at least two ways. First, Arena sets forth the conclusion that higher temperatures prevent the selective production of arabinose:

> **[A]cid hydrolysis is conducted at a temperature less than about 80° C**. The reason for this rests on the observation that acid hydrolysis of corn kernel hulls at lower temperature affords a mixture rich in the **pentoses** [which includes arabinose] and with a relatively low glucose content, and **hence affords a selectivity unattainable at higher temperatures**. (col. 4, lines 13-18; emphasis and brackets added).

Arena expressly states that selective production of pentoses, such as arabinose, is not attainable at temperatures above 80° C. This statement clearly teaches away from a combination with Weibel's method using temperatures greater than 125° C. For at least this reason, applicants'

invention is patentable over the combination. Arena's experimental results also teach away from the Office's combination.

Second, Arena's experimental data confirm for those of ordinary skill in the art that arabinose cannot be selectively produced using corn kernel envelopes at Weibel's temperatures. Arena's Example 1 and Table 1 (col. 5, lines 37-63) show that, using Arena's method, corn kernel hulls were hydrolyzed to selectively produce arabinose at 60° C. But, as Arena raised the temperature, the percentage of arabinose as the amount of hydrolyzed glucose, xylose, and arabinose decreased. At 60° C, arabinose was 50% of the hydrolyzed glucose, xylose, and arabinose. At 70° C, arabinose was 39% of the hydrolyzed glucose, xylose, and arabinose. At 85° C, arabinose was 23% of the hydrolyzed glucose, xylose, and arabinose. At 100° C, arabinose was 23% of the hydrolyzed glucose, xylose, and arabinose. Arena's experimental results show that increasing temperature above 60° C (i.e., in the direction of Weibel's temperatures over 125° C) will reduce or prevent the selective production of arabinose from corn kernel hulls. Thus, Arena's experimental results also teach away from a combination with Weibel. For at least this reason, applicants' invention is patentable over the combination.

Arena also teaches away from Weibel's acid concentration. Arena's preferential production (arabinose as 50% of hydrolyzed glucose, xylose, and arabinose) was achieved using 7% sulfuric acid. Arena discloses that acid concentrations may be in a range from about 0.5% to about 15% by weight, and are, more typically, in the 3% to 10% weight range (col. 3, lines 26-28). For sulfuric acid, a concentration of 0.5% to 15% corresponds to 0.19 N to 5.63 N. Weibel discloses an acid concentration between 0.01N and 0.10N (col. 17, lines 48-55).

Arena's broadest acid concentration is outside of the range of Weibel's broadest acid concentration, and Arena's typical or preferred acid concentration of between 3% to 10% teaches one of ordinary skill to move even further away from Weibel's concentration. For at least this reason, applicants' invention is patentable over the improper combination.

The Office's Motivation to Combine

The Office argues that one of ordinary skill would be motivated to use Arena's corn kernel hulls with Weibel's method because, as disclosed by Arena, corn kernel hulls can be hydrolyzed without a delignification treatment. The Office also argues that Arena teaches

applicants' starting material of corn kernel hulls and applicants' result of selective production of arabinose.

Given that Arena discloses (1) applicants' starting material and (2) a method to achieve selective production and (3) provides the Office's stated motivation that corn hulls can be hydrolyzed without delignification, why wouldn't one of ordinary skill just use Arena's method? What would motivate one of ordinary skill to replace Arena's successful method with Weibel's method, given that Weibel uses a different starting material for a different purpose, and uses reaction parameters that Arena teaches will not work?

The references must be considered for what they would suggest to one of ordinary skill in the art. One of ordinary skill having (1) corn kernel hulls, (2) a desire to selectively produce arabinose from those corn kernel hulls and (3) Arena, would use Arena's method. Without a motivation to disregard Arena's method, a prima facie case has not been established. However, even if the Office is able to generate a motivation to depart from Arena's method, there would be no motivation for a departure in the direction of Weibel. The references so loudly teach away from their combination, the claimed invention would still be patentable over the improper combination.

To combine references, there must be some teaching, suggestion, or reason to combine the references, and motivation to combine means that the combination is desirable. *Winner International Royalty Corp. v. Wang.*, 53 USPQ2d 1580, 1587 (Fed. Cir. 2000). A combination of Weibel with Arena is simply not desirable for one of ordinary skill in the art trying to achieve what Arena achieves.

Arena Destroys Any Expectation of Success

There must be a finding that one of ordinary skill in the art at the time the invention was made would have reasonably expected the claimed invention to work. *In re Dow Chem.*, 837 F.2d, 473, (Fed. Cir. 1988). As discussed above, Arena's Example 1 and Table 1 show that as temperature increases above 60° C, the expectation of successfully achieving selective production of arabinose decreases. One of ordinary skill, based on Arena, would have no expectation of successfully achieving the selective production of arabinose at temperatures much

above 60° C. Thus any expectation of achieving selective production at Weibel's temperature greater than about 125° C would be destroyed.

For at least this reason, applicants' invention is patentable over the improper combination.

The Office Is Not Considering What the References Disclose

The Office states that the "prior art clearly shows that yield is dependant on a combination of factors such as temperature and pH and would have been readily recognized by one of ordinary skill in the art at the time of the invention" (page 4 of the Action). Applicants agree. The Office, however, fails to consider *what* the references set forth about how temperature and pH are related to yield.

Arena clearly shows that selective production is related to temperature. Arena shows that as temperature is increased above 60° C, there is no selective production. As noted, Arena expressly teaches away from Weibel's temperature and from Weibel's acid concentration. Arena expressly destroys any expectation of success at Weibel's 125° C. Even if those of ordinary skill having Arena were to tinker with pH or temperature, they would not tinker up to Weibel's temperature with the expectation of getting selective production of arabinose. Applicants believe this addresses any concerns the Office has about modifying temperature or pH of either reference to achieve the claimed invention.

Unexpected Results

Applicants' results, achieved using applicants' methods, are unexpected. Arena states, and shows through experimental information, that raising the temperature of the reaction would reduce or prevent the selective production of arabinose. But, applicants were able to selectively produce arabinose at temperatures where Arena said such results were "unattainable". Unexpected results are a hallmark of nonobviousness. *U.S. v. Adams*, 383 U.S. 36 (1966).

Conclusion

In summary: (1)Weibel teaches away from a combination with Arena; (2) Arena teaches away from a combination from Weibel; (3) one of ordinary skill having Arena and wanting to

selectively produce arabinose from cork kernel hulls would have no motivation to use Weibel's method; and (4) based on Arena's statements and experimental results, one of ordinary skill in the art would not expect the successful results of the present invention. Applicants submit that any of these reasons make all of the claims of the present invention patentable over the Weibel-Arena combination. The other references are unable to fill these voids. Applicants believe the current amendment has placed the case in condition for immediate allowance and such action is respectfully requested. If, however, any issue remains unresolved, applicants' attorney would welcome the opportunity for a telephone interview to expedite allowance and issue.

Respectfully submitted,

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